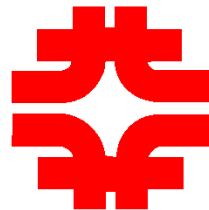


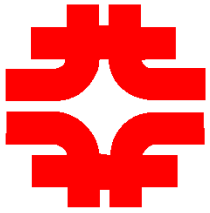
# US LHC Accelerator Research Program

Instrumentation Collaboration Meeting

John Marriner

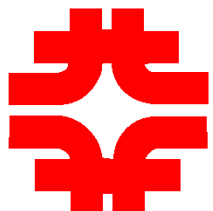
May 9, 2003





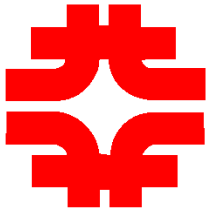
# US LARP

- LARP = LHC Accelerator Research Program
- LARP is an outgrowth of the US LHC Accelerator Project
- The US LHC Accelerator Project built magnets for the LHC IR insertions and supported LHC accelerator physics calculations.



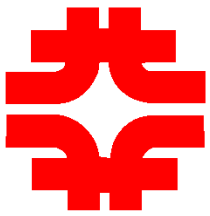
# US LARP Goals & Motivation

- Keep skills sharp by helping CERN commission the LHC – a once-in-a-decade opportunity.
- Conduct forefront accelerator physics research and development.
- Advance our national capability to improve the performance of our own accelerators.
- Prepare U.S. accelerator scientists to design the next generation of hadron colliders.
- Develop the advanced accelerator technologies necessary to build the next generation of colliders after the LHC.



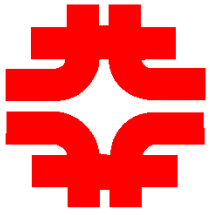
# The US LARP Program

- Bring the LHC on and up to design luminosity quickly, safely and efficiently.
- Continue to improve LHC performance by advances in understanding and instrumentation.
- Use the LHC effectively as a tool to gain a deeper knowledge of accelerator science and technology.
- Extend LHC as a frontier high-energy physics instrument with a timely luminosity upgrade.



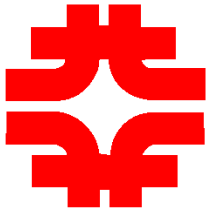
# Initial Instrumentation Suite R&D

- Tune, Chromaticity and Coupling Feedback
  - LHC is more susceptible and sensitive to magnetic drifts than Tevatron & RHIC
  - Exact scope of this project is yet to be determined
- Real-Time Luminosity Measurements
  - There are two competing technologies: gas ionization chamber (LBNL) and (CdTe)f solid state devices (CERN).
  - Radiation tests of both at the FNAL Booster later this year.
  - LARP has proposed R&D on gas-ionization technology
- Longitudinal Beam-Density Monitor
  - LBNL proposal based on synchrotron radiation
  - Measures beam with no rf structure (e.g., in abort gap)



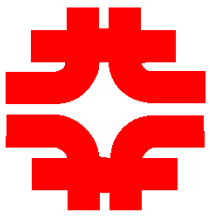
# Additional Instrumentation

The US LARP draft proposal states “There are a number of instruments and diagnostics that will possibly be very useful for the LHC, and for which the U.S. laboratories can supply expertise, but which are not part of the initial work scope. Either they are more technologically speculative, their need is not well-established, or there is generally less interest in them at the present time.”

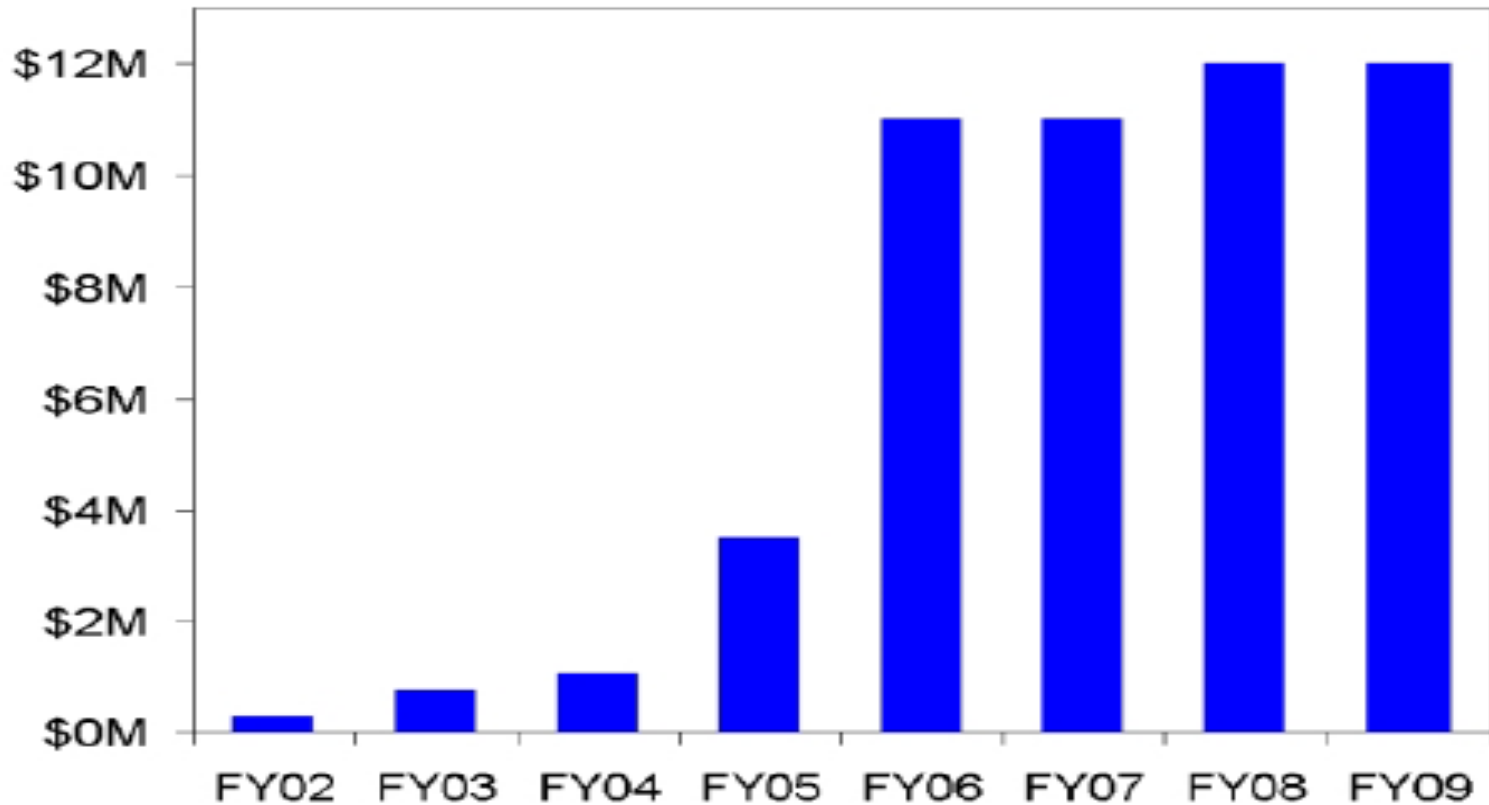


# Additional Instrumentation

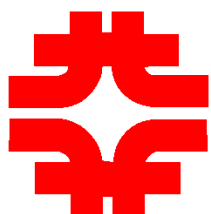
- Beam-beam compensation systems
  - Electromagnetic wire
  - Electron lens
- High-Frequency Schottky Detectors
  - Narrow band system makes rapid, low noise measurements
  - Wide band system makes bunch-by-bunch measurements
- AC Dipoles
  - Excite betatron oscillations non-destructively
  - Measure with BPMs the linear, near-linear, and non-linear properties of the beam



# Preliminary DOE Funding Guidance

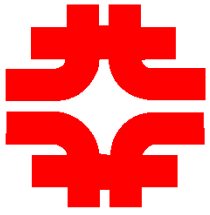






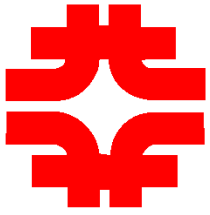
# Level of Effort from draft LARP proposal

	<i>FY04</i>	<i>FY05</i>	<i>FY06</i>	<i>FY07</i>	<i>FY08</i>	<i>FY09</i>	<i>FY10</i>	<i>FY11</i>
<b>Hardware commissioning</b>								
At a U.S. Lab	0.5	0.5	-	-	-	-	-	-
At CERN	-	1.5	2	1	-	-	-	-
<b>Beam Commissioning</b>								
At a U.S. Lab	0.5	1	2	2	-	-	-	-
At CERN	-	0.5	2	5	7	7	4	2
<b>Initial Instrumentation</b>	2	3	4	5	3	-	-	-
Tune Feedback								
Luminosity Monitor								
Longitudinal Density Monitor								
<b>Additional Instrumentation</b>								
At a U.S. Lab	-	-	-	-	1	2	2	2
At CERN	-	-	-	-	-	1	1	1
<b>Fundamental Accelerator Physics</b>								
At a U.S. Lab	1	1	2	2.5	3	3.5	4.5	5
At CERN			1	1.5	2	1.5	1.5	1
<b>TOTAL</b>	4	7.5	13	17	16	15	13	11



# FNAL Role

- Tune tracker plan
  - FNAL will collaborate with BNL
  - Will develop separate systems for ~2 years
  - Will make joint proposal in ~2005
- Tevatron Electron Lens
  - CERN interested in using pulse wire at IR's
  - TEL is a complementary approach
  - Will propose project (~2M\$) if seems promising for LHC



# Purpose of Meeting

- To exchange information on tune trackers, schottky PU's, and other devices of mutual interest.
- To discuss LHC requirements.
- To discuss and lay the ground work for possible future collaborative efforts.